SUBJECT: Third Annual Conference on Atmospheric Contamination in Confined Spaces, Dayton, Ohio, May 9-11, 1967 - Case 330

DATE: June 26, 1967

FROM: T. A. Bottomley, Jr.

MEMORANDUM FOR FILE

The Third Annual Conference on Atmospheric Contamination in Confined Spaces was held in Dayton, Ohio, on May 9-11, 1967.

The conference was sponsored by Aerospace Medical Research Laboratories, Wright-Patterson Air Force Base, Ohio. Attendance was by invitation and included representatives from industry, universities, and various agencies of the federal government.

The majority of papers presented were related to toxicological evaluation of atmospheres and contaminants under space cabin conditions. In general, these papers provided updated reports of experiments in process which were discussed at previous sessions. There were, however, more papers covering selection of cabin materials, instrumentation and detection techniques, and life support systems, than were presented at any of the previous sessions.

As in the past, copies of the proceedings were not available at the conference. The sponsoring organization anticipates that they will be printed and distributed in three to six months.

The following is a summary of findings reported at the conference which appear to be pertinent to the Apollo and Apollo Applications Programs:

1. Atmosphere Selection - Based on animal experiments 5 psia pure oxygen resulted in no pathologic symptoms after two weeks exposure except for increased pulmonary resistance. A number of papers reported on the results of animal tests conducted in 5 psia for 70% oxygen, 30% nitrogen for eight months. There were no significant findings which precluded the use of this atmosphere for man.

(NASA-CR-88687) THIRD ANNUAL CONFERENCE ON ATMOSPHERIC CONTAMINATION IN CONFINED SPACES (Bellcomm, Inc.) 4 p

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BELLCOMM, INC.

SUBJECT: Third Annual Conference on Atmospheric Contamination in Confined Spaces, Dayton, Ohio, May 9-11, 1967 - Case 330

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ABSTRACT

The Third Annual Conference on Atmospheric Contamination in Confined Spaces was held in Dayton, Ohio, on May 9-11, 1967.

In general, the papers presented updated findings of experiments reported in previous years.

Findings pertinent to current space flight programs were:

1) A 5 psia 70% oxygen:30% nitrogen environment appears physiologically safe for missions up to 8 months duration based on animal tests.

2) Ethylene glycol contamination of the cabin atmosphere is undersirable even in very low concentrations.

3) Double resonance spectrometry, newly developed for in-flight gas analysis, may provide greater sensitivity and faster readouts than existing hardware.

4) Certain combinations of toxicants and bacteria and of toxicants and drugs may prove dangerous to the crew and need to be evaluated.

5) Activated charcoal left in place during cleaning and painting of Sea Lab II was a major source of contamination in the early phases of a subsequent test.

It is the writer's viewpoint that more emphasis needs to be placed on the following in contaminant test programs:

a) classification of compounds into similar groups to effect savings in test time and money,

b) gathering data on the time-rate of material off-gasing,

c) evaluation of remedial measures for improving the properties of materials (such as curing processes), and

d) testing prototype atmosphere revitalization systems for contaminant control in conjunction with contaminant testing.

[redacted]

2. Ethylene Glycol Toxicity - A variety of animals were exposed to 254 mg/m3 of ethylene glycol for a period of 21 days in an atmosphere of 5 psia pure oxygen. Kidney injury was noticed in rabbits. Exposed rats and guinea pigs had reduced weight gain in comparison with controls. A number of experts felt it was important to emphasize that ethylene glycol was much more toxic to man than to animals. Dr. Kenneth Back pointed out that Wright-Patterson Air Force Base was not willing to respond to a NASA/MSC request to set values for maximum allowable concentration of ethylene glycol use in the Apollo program. It was his feeling that even very low concentrations were undesirable.

3. Instrumentation - Quantitative analysis of atmospheric contaminants is normally accomplished by gas chromatography or mass spectrometry. The two techniques are often used in combination in the laboratory. One new development in spectrometry appears very promising. This was categorized as double resonance spectrometry and is based on wave guide principles. It is anticipated that this instrument will be able to separate and identify compounds with a sensitivity of one in three thousand and provide readouts in 30 seconds.

4. Deleterious Combinations - Several papers emphasized the importance of protecting against the combined effects of toxicants and bacteria (e.g., ozone and streptococcus) and of contaminants and drugs. One case was cited in which an antibiotic prophylaxis was administered to 50 rats at altitude and to an equal number of controls in ambient air. Almost all of the test animals died while the controls survived.

5. Sea Lab II Results - Over 40 hydrocarbon contaminants (average molecular weight = 100-125) were identified during the six-week Sea Lab II Project. The main sources of contaminants were adhesives and paints. Significantly, activated charcoal, which was left in the atmosphere revitalization unit during the use of cleaning solvents and painting, was the major contributor to contaminant levels during the early stages of the test as a result of off-gasing. Other findings of concern were the continuous build-up in methane and carbon monoxide (which are not absorbed by the charcoal) over the period of the test.

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In summary, contaminant test programs have not made significant progress in the past year. It is the writer's opinion that the following are areas where savings and gains could be made in the overall contaminant testing program:

a) Classification of toxic compounds into groups which would permit extrapolation of test results to other compounds having similar properties in order to effect economies in test time and facilities,

b) Establishment of time-rate of off-gasing from test materials during long-term runs,

c) Evaluation of remedial measures such as curing processes, establishing surface area to volume and mass relationships, and examining the interaction with other environmental stresses (e.g., heat, humidity, etc.), and

d) Testing the effectiveness of various prototype contaminant control systems with particular attention directed to the production of secondary contaminants by the contaminant control system.

T. A. Bottomley, Jr.

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